

13. The method of claim 9 wherein the transmission line is secured within a circuit board.

14. The method of claim 9, further comprising:

insulating the transmission line from the bulk material being measured.

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15. The method of claim 9 further comprising:

using a circuit board to route signals, secure circuit components, and secure the transmission line.

REMARKS

This responds to the Office Action dated 14 August 2002, and follows the in-person interview involving Applicant's representative, L. Grant Foster, and Examiner Andre J. Jackson and Supervisory Patent Examiner Daniel Larkin on 6 December 2002.

Specification Objections

The Examiner has objected to the specification for failing to provide antecedent basis with respect to the words "semiconductor circuit" used in the claims. Applicant has amended the detailed description portion of the application to recite the words "semiconductor circuit." The words "semiconductor circuit" are found in the original claims (which comprise part of the original specification), and are well understood by those of ordinary skill in the art. Accordingly, no new matter has been presented with respect to this amendment to the specification. The

above-discussed amendment should therefore remedy the objection to the specification made by the Examiner.

Claim Objections

The Examiner has indicated that the word "and" should be inserted after the last semicolon of each of claims 1, 4, 5, 6, 7, and 8. Claims 1 and 8 have been canceled, thus obviating the objection relative to these claims. Applicant respectfully submits that with respect the other claim objections, there is no requirement to include the word "and" just prior to the last clause of each claim, as suggested by the Examiner. The clauses recited in the claims read grammatically correctly without the proposed "and" word. Thus Applicant respectfully requests the Examiner to reconsider the objections. If, however, the Examiner disagrees and insists on maintaining his objections, Applicant requests a telephone conference with the Examiner to resolve these minor issues.

Claim Rejections Under 35 U.S.C. § 103

The claim rejections based upon U.S. Patent No. 5,455,178 to Feuer in view of U.S. Patent No. 4,341,112 to Mackay were discussed at length during the in-person interview conducted on 6 December 2002. In summary, Feuer does not teach or suggest measuring the phase lag of a signal sent through a transmission line as compared to a reference square wave voltage signal to determine the amount of water present in a bulk material. The Examiner has acknowledged this lack of teaching in the Feuer patent in his Office Action (see page 4 of the Office Action). The Mackay et al. reference shows two leaky transmission lines that are placed some distance apart to measure the time it takes to transmit a signal from one transmission line to another (*i.e.*, the transmission lines act

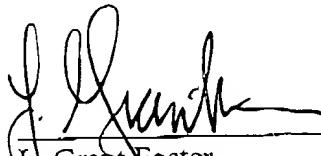
as transmitting and receiving antennae). The "phase" referenced in the Mackay et al. patent has nothing to do with any measurement, but relates instead only to the method used to determine the time taken for a wave to traverse the distance between the two antennae. As agreed during the interview, the proposed combination of Mackay et al. with Feuer would be improper. As agreed, therefore, neither Feuer nor Mackay et al., either alone or in combination, teaches or suggests the invention of claim 2 (which has now been rewritten in independent form) or claim 6. Thus these claims, as well as their respective dependent claims, should be in condition for allowance.

Claim 6 has been amended to resolve a potential antecedent basis objection noticed by Applicant. No narrowing amendment has been made to claim 6.

Also as discussed during the interview, Applicant submits new method claims 9 –15, all of which recite, via independent claim 9, the limitations of measuring the phase difference between a signal provided to a transmission line and a reference signal to determine the water content of a bulk material. The limitations recited in claim 9 recite the patentable subject matter agreed upon during the in-person interview. Accordingly, these method claims should be allowable over the prior art of record.

Applicant respectfully submits that all matters have now resolved with respect to the present application. Applicant respectfully requests reconsideration and a favorable action on the merits. If there remain any outstanding issues to be resolved, Applicant's undersigned attorney respectfully requests the Examiner to initiate a telephone call to resolve all remaining issues.

Respectfully submitted,



L Grant Foster
Registration No. 33,236

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claim 2 has been amended as follows:

2. (Amended) [The sensor as recited in claim 1] A sensor for measuring the water content of bulk materials comprising:
first and second elongate members, each having substantially identical shape and size so that
the first and second members mate with one another and are bonded together to form a sensor;
sensor electronics mounted on the first member, the sensor electronics being protected by a housing, the sensor electronics being responsive to a direct current excitation for providing an output signal which is proportional to an amount of water present in a bulk material;
wherein the sensor electronics comprise:
an oscillator responsive to a direct current excitation, to provide a square wave signal;
a transmission line being coupled to receive the square wave voltage signal from the oscillator through a resistor, and a phase detector to detect a difference in phase between the square wave voltage signal provided by the oscillator and the signal provided to the transmission line, the phase detector being further constructed to provide an output signal indicative of the difference in phase between a square wave signal provided to the transmission line through the resistor and the response of the transmission line.

Claim 5 has been amended as follows:

5. (Amended) The sensor as recited in claim [1] 2 where the dielectric constant of a bulk medium is sensed using a transmission line embedded in the bulk material; the transmission line comprising traces on an elongated printed circuit board, the circuit board further comprising a semiconductor circuit.

Claim 6 has been amended as follows:

6. (Amended) A sensor for measuring water content of bulk materials, the sensor being powered by a direct current excitation, the sensor comprising:
an oscillator to provide a square wave voltage signal;
a transmission line having an input and an output, the transmission line input being coupled to receive the square wave voltage signal, the transmission line output being coupled to a phase detector;
the [a] phase detector detecting [to detect] a phase difference between the square wave voltage signal provided by the oscillator and the signal provided to the transmission line, the phase detector providing an output signal indicative of the phase difference caused by changes in moisture content of a medium surrounding the transmission line.